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THE ECONOMICS OF A REPLACEMENT FOR CHALLENGER

If it is assumed that a fourth orbiter could be used for launch operations on a relatively unrestricted basis it is pertinent to examine what the approximate unit flight cost would be. Previous analyses by CBO and NASA* have yielded base annual operating cost models for a four shuttle fleet as follows:

CBO: $\$1008 + N \times \$42,$

NASA: $\$1344 + N \times \$28,$

where N is the number of annual flights, and costs are in millions of 1982 dollars.

These formulas were derived from a nominal case of 24 launches per year with CBO taking the ratio of fixed to variable costs as 50/50 and NASA as 2/3 to 1/3. The respective formulas yield the following costs per flight at the indicated annual flight rates:

Average Operating Cost per Flight (1982 \$Million)

	Flights Per Year		
	12	18	24
CBO Model	126	98	84
NASA Model	140	103	84

Putting these values into 1986 dollars, yields:

Average Operation Cost per Flight (1986 \$Million)

	Flights Per Year		
	12	18	24
CBO Model	147	114	98
NASA Model	163	120	98

This would suggest that the surviving three orbiter fleet which is expected to be able to sustain launch rates of from 4 to 6 launches per year per orbiter will have flight costs in the range from \$114 to \$120 million per flight if the higher utilization rate is achieved and between \$147 and \$163 million per flight if the lower utilization rate is achieved.

* As reported by CBO

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The incremental costs associated with adding a fourth orbiter can also be split between "fixed" and "variable" costs. Under fixed costs we add the annual cost of amortizing the acquisition cost. This is of course a function of the acquisition cost, the amortization period and the interest rate assumed. For the presently predicted acquisition cost of about \$2.5 billion, the following amortization costs would apply:

Annual Amortization Cost (1986 \$Million)

	<u>Amortization Period</u>	
	<u>10 years</u>	<u>15 years</u>
At 8 percent	373	292
At 12 percent	442	367

Converting the variable costs of \$42 million and \$28 million per flight for CBO and NASA, respectively, to 1986 dollars and combining with the incremental fixed cost, yields:

Incremental Cost per Flight of Fourth Orbiter (1986 \$Million):

	<u>CBO Model</u>		<u>NASA Model</u>	
	<u>Flights Per Year</u>			
<u>Amortization Plan</u>	<u>4</u>	<u>6</u>	<u>4</u>	<u>6</u>
8 percent/10 years	142	111	121	90
8 percent/15 years	122	98	106	82
12 percent/10 years	160	123	144	107
12 percent/15 years	141	110	125	94

Hence, if (1) it turns out that the STS can be put back on track without running up its operating costs, and (2) there is a market for the additional STS flight opportunities at prices equal to or greater than those indicated above; then, the acquisition of a fourth orbiter could be justified on economic grounds alone.

These costs can also be interpreted as those at which ELVs would become competitive with a fourth orbiter, assuming both launch vehicles were vying for the same missions.